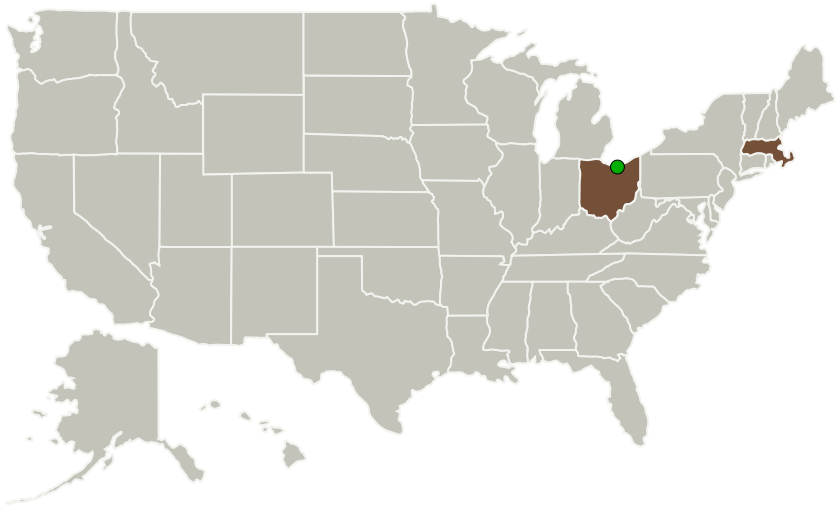
# High Efficiency Quantum Well Waveguide Solar Cells, Phase I

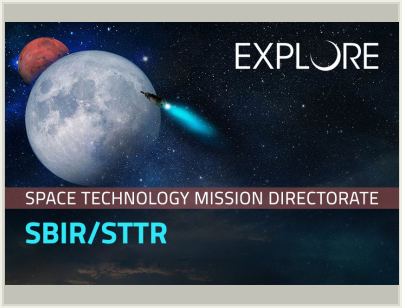
Completed Technology Project (2011 - 2011)

## Project Introduction

The long-term objective of this program is to develop flexible, lightweight, single-junction solar cells using quantum structured designs that can achieve ultra-high efficiencies (approaching 45%) while avoiding the current matching issues that plague high-efficiency multi-junction devices. Ultra-low dark currents and record-high open circuit voltages have recently been achieved with a novel III-V material structure that includes both an InGaAs quantum well absorber and an extended wide band gap emitter. By enhancing absorption in the narrow band gap well, power conversion efficiencies in single-junction quantum solar cells can potentially exceed those of multi-junction photovoltaic devices. The objective of the Phase I SBIR effort is to design and prototype a high performance quantum well solar cell device incorporating advanced light trapping techniques. To enhance light trapping, we will leverage both an established epitaxial liftoff process and unique optical coatings to scatter light laterally into waveguide modes within the InGaAs well region of the device.

## Primary U.S. Work Locations and Key Partners






High Efficiency Quantum Well Waveguide Solar Cells, Phase I

## Table of Contents


| | |
|---|---|
| Project Introduction | 1 |
| Primary U.S. Work Locations and Key Partners | 1 |
| Project Transitions | 2 |
| Organizational Responsibility | 2 |
| Project Management | 2 |
| Technology Maturity (TRL) | 2 |
| Technology Areas | 3 |
| Target Destinations | 3 |

# High Efficiency Quantum Well Waveguide Solar Cells, Phase I

Completed Technology Project (2011 - 2011)

| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Magnolia Solar, Inc. | Lead Organization | Industry | Woburn, Massachusetts |
| Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |

| Primary U.S. Work Locations | |
|---|---|
| Massachusetts | Ohio |

## Project Transitions

**February 2011:** Project Start

**September 2011:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/138194)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Magnolia Solar, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

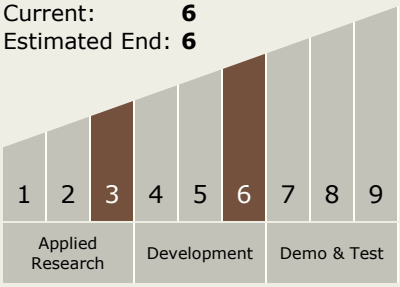
Carlos Torrez

**Principal Investigator:**

Roger E Welser

## Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



# High Efficiency Quantum Well Waveguide Solar Cells, Phase I

Completed Technology Project (2011 - 2011)

## Technology Areas

**Primary:**

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.1 Photovoltaic

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System